

Amendment under 37 C.F.R. § 1.111
Application No. 10/659,436

AMENDMENTS TO THE DRAWINGS

Figures 8-10

Attachment: Replacement Sheets

REMARKS

Claims 1-10 are pending in the application. Claims 1 and 6-10 are rejected. Claims 2-5 are objected to but would be allowable if placed into independent form. Applicant has cancelled claim 1 and placed claims 2, 4 and 5 into independent form. Applicant also has amended claim 6 to add the limitations of allowable claim 2. Claims 7-10 also have been amended to emphasize the performance of high accuracy measurements. New claims 11 and 12 have been added to define the invention in terms of a formula.

Information Disclosure Statement

The Examiner notes that the IDS submitted on June 4, 2004 contains a reference to Small, a copy of which was submitted and a complete identification of which was provided on form 1449, other than an identification of the publication date. As is clear from the face of the Small publication, the publication date is 1992. Applicant is submitting a supplemental form 1449 listing the Small publication alone. Applicant respectfully submits that the Examiner had full possession of the document and should have considered it at the time of examination. Thus, no additional fee should be required.

The Examiner also notes that the IDS submitted on July 9, 2004 is improperly worded because it refers to an expected date of publication. Applicants have examined the IDS and cannot determine the basis for the Examiner's comment. In any event, Applicants respectfully note that all of the references listed in the IDS has been considered by the Examiner, as indicated by the initials of the Examiner next to each listed item.

Finally, Applicants are submitting another IDS concurrently, which identifies the result of an examination in a corresponding application in Japan.

Drawings

The Examiner objects to the drawings, particularly Figs. 8-10, because of the misspelling of the word "REFRIGERANT". Replacement drawings with a correct spelling are being submitted.

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Specification

The Examiner has noted a typographical error at page 5, line 22 and page 50, line 8 with respect to the referenced view. Appropriate correction has been made.

Claim Objections

Claim 1 is objected to because the claim lacks a number. This objection is moot in view of the cancellation of the claim.

Claim Rejections – 35 USC 103

Claims 1 and 6-10 are rejected under 35 USC 103(a) as being unpatentable over Anderson et al (5,610,398) in view of Adachi et al (5,351,198). This rejection is traversed for at least the following reasons.

The present invention generally concerns a mixed-refrigerant analyzing apparatus 1 having a cell 2 in to which a mixed refrigerant S containing a plurality of refrigerant components is supplied as sample gas. An infrared light source 3 directs infrared light into the cell such that it passes through the refrigerant S and exits the cell 2, and engages a plurality of bandpass filters 9a-9i having wavelengths which are fitted to infrared absorption spectra of the respective refrigerant components. A plurality of detectors 4a-4i are provided, each for measuring the intensity of the infrared light that has passed through a respective one of the bandpass filters. A calculation processing unit 6 is used to analyze the infrared light intensity of the respective wavelength ranges so as to acquire concentration of the respective measuring-subject components. Notably, the calculation processing unit 6 is operative to execute a program P for analyzing the concentration of the respective measuring-subject components (1) by solving simultaneous equations (2) that have mutual interference correction terms used to correct interference adverse influences that occur among the respective measuring-subject components, (3) wherein the mutual interference correction terms include a product made by multiplying a product of concentration of at least two measuring-subject components by one or more mutual interference correction coefficients.

Claims 1 and 6

As to claim 1, the rejection is moot in view of the cancellation of the claim.

As to claim 6, the claim has been amended to incorporate the limitations of claim 2 that the Examiner found to be a basis for patentability. Original claim 2 specifies that the mutual interference correction terms include a product made by multiplying a product of concentration of at least two measuring-subject components by one or more mutual interference correction coefficients.

Claims 7-10

The subject matter of these claims is an apparatus 1 having a cell 2 for a mixed refrigerant S where an infrared source 3 is directed to the cell 2. The passing light engages a plurality of bandpass filters 9a-9i, having wavelengths which are fitted to infrared absorption spectra of the respective refrigerant components, and the filtered light is detected by a plurality of detectors 4a-4i . At least two bandpass filters are provided among such bandpass filters, wherein the infrared transmission central wave numbers are set to one of a group of 1180 to 1192 cm^{-1} , 1065 to 1088 cm^{-1} , 981 to 1000 cm^{-1} , 908 to 933 cm^{-1} and 798 to 820 cm^{-1} , and/or one of a group of 1222 to 1235 cm^{-1} , 1205 to 1220 cm^{-1} , 1263 to 1269 cm^{-1} , and 1137 to 1151 cm^{-1} .

The Examiner argues at page 6 that Anderson et al teaches the claimed structure and at least one of the recited ranges based on the disclosure at col. 4, line 28. The Examiner asserts on the basis of the teachings in Adachi that infrared transmission central wave numbers must be chosen to avoid interference, as at col. 13, lines 1-16 and col. 14, lines 40-54, and the desire for improved calculation of component concentrations as at Fig. 10, it would have been obvious to set infrared transmission central wave numbers of bandpass filters 32 to provide a sufficient difference between corresponding peak values and valley values while avoiding points at which absorption is increased by interferential ingredients. The Examiner finds the specific ranges to be a matter of choice within the knowledge of those of ordinary skill in the art, in view of known spectra of the refrigerator components in isolation.

First, while Anderson et al teaches the calculation of cross sensitivity for the respective refrigeration gases, there is no teaching or suggestion that the spectrum of the filters 32 for each detector 30 would be anything other than the precise range for a desired component. Second, the compensation occurs at the detector and not at the filter. Third, as to Adachi, there is no teaching

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or suggestion at all that there is a filter, especially a filter for respective detectors assigned to different components.

In light of the foregoing factors, Applicants respectfully submit that the Examiner must resort to the improper use of hindsight to create the invention as claimed. Applicants submit that, as taught at pages 59-64, they have identified specific ranges of infrared transmission central wave numbers that are precise and effective for detecting the content of a mixed refrigerant.

Finally, Applicants have amended the claims to emphasize the high accuracy measurement that is performed and to state:

"wherein each range of said infrared transmission central wave numbers is set on the basis of a suppression of mutual interference degrees caused by said components."

New Claims

In order to capture the mathematical basis for the invention, Applicants have added two new claims based on equations 3 and 4 in the disclosure.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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